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The violets of Staten Island

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(WITH PLATES 11–18)

This list of the native violets growing on Staten Island is the result of several years of intensive study of the plants in the field and in cultivation at home. In the case of some of the hybrid plants, their identity could be established only by thus keeping them under constant observation through at least one season; and so there may be found in violet collections a number of specimens that cannot be identified with any degree of certainty. A number of such specimens from Staten Island are not included in this list.

Violets in general grow well in cultivation, even in a small city lot, like my own garden, but a few do not thrive so well and are less easily grown. In general they retain in cultivation the same characters as in their natural habitat, but those transplanted from moist or shady woodlands have acquired more or less the character of the same species growing naturally in the open. A plant of *V. papilionacea*, for example, transplanted from the Emerson Hill woods, acquired the characteristics of the form that has been described as *V. domestica*.

Acknowledgments are due to Dr. E. Brainerd, to whom we owe so much of our present knowledge of violets, and who kindly examined my earlier collection of violets, and to Dr. Homer D. House, who has presented his extensive collection of violets to the Staten Island Association of Arts and Sciences and thus made it available for general study.

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Key to the Staten Island species of violets

I. *Acaulescent: leaves and flowers directly from underground stems*

Leaves lobed or deeply cut.
- Leaves parted into many slender radiating divisions; style not beaked. 1. *V. pedata.*
- Leaves shallowly or deeply lobed, with a main middle part; style slightly beaked.
  - Plants not hairy, or but slightly so on the upper surface and margin of leaf; capsules green. 2. *V. Brittoniana.*
  - Plants more or less hairy on leafstalks and flower stalks; capsules mottled with purple.
    - Leaves variable, slightly irregularly lobed or deeply parted. 8. *V. palmata.*
    - Leaves, or some of them, three-lobed, the others not lobed. 9. *V. triloba.*

Leaves not lobed.
- Petals blue or lavender.
  - Capsules green, on erect stalks.
    - Plants not hairy, or but slightly so on the upper surface and margin of leaf.
      - Leaves broad, pectinately toothed or regularly incised. 3. *V. pectinata.*
      - Leaves broad, crenate, deeply cordate; seeds nearly black. 4. *V. cucullata.*
      - Leaves triangular-ovate, truncate at base, with larger teeth at base. 5. *V. emarginata.*
      - Leaves sagittate or oblong-ovate, narrower than in the preceding. 6. *V. sagittata.*
    - Plants hairy, leafstalk usually not much longer than the blade. 7. *V. fimbriatula.*
  - Capsules usually mottled with purple, on prostrate to ascending stalks.
    - Plants distinctly hairy on leafstalks, or with long hairs on the upper surface of leaf.
      - Flower stalks and leafstalks hairy. 10. *V. sororia.*
      - Upper surface of leaf with rather long hairs, otherwise not hairy, plants low. 11. *V. hirsutula.*
    - Plants not hairy, or only slightly so on upper surface and margin of leaf.
      - Leaves not deeply cordate; capsules often finely hairy, on ascending stalks; auricles of calyx ciliolate, seeds buff. 12. *V. affinis.*
      - Leaves cordate, larger than in the preceding; capsules larger, never hairy; closed flowers at first prostrate; ripe seeds dark. 13. *V. papilionacea.*
- Petals white, some streaked with purple; plants freely spreading by slender stolons.
  - Blade of leaf hairy on at least one surface.
    - Leaves hairy on the upper surface, otherwise nearly smooth. 14. *V. blanda.*

Leaves not hairy on the upper surface, plant otherwise hairy. 15. *V. incognita.*
Blade of leaf not hairy on either surface.
Blades rounded, cordate; seeds small, nearly black. 16. *V. pallens.*
Blades ovate to ovate-lanceolate; seeds larger, brown. 17. *V. primulifolia.*
Blades lanceolate to narrowly lanceolate; seeds dark brown. 18. *V. lanceolata.*
Petals yellow; leaves pale beneath, spreading close to the ground. 19. *V. rotundifolia.*

II. *Caulescent: with stems above ground bearing leaves and flowers*

Petals yellow.
Plants decidedly hairy. 20. *V. pubescens.*
Plants not hairy or only slightly so. 21. *V. scabriuscula.*
Petals blue. 22. *V. conspersa.*

Note. — No attempt is made to include the hybrids in the key. In the following list the numbers given without collector's name refer to my own collection. In the case of common species, when only one record is given, it is the earliest complete record I have found.

1. VIOLA PEDATA L. Sp. Pl. 933. 1753

Occasional in the Todt Hill region and in the sandy regions on the west side of the island, rarely elsewhere. Some of the earlier records are: Todt Hill, May 12, 1877, *M. Ruger;* Court House, May 10, 1879, and Kreischerville, June 5, 1879, *N. L. Britton;* Mariner Harbor, May, 1881, *C. O. Thompson.* Specimens with white flowers, Todt Hill, May, 1882, *N. L. Britton,* and Garretsons, May 10, 1890, *G. D. Hulst;* with double flowers, Watchogue, May 11, 1884, *Arthur Hollick;* in blossom Nov. 4, 1883, Tottenville, *Arthur Hollick.* Our plants have the characters of var. *linearilobа* DC.

2. V. BRITTONIANA Pollard, Bot. Gaz. **26**: 332. 1898

V. septemloba of authors, not LeConte.
V. atlantica Britton, not Pomel.

New Dorp, May 8, 1876, *N. L. Britton.* Common on the lowlands. It was admitted on the authority of Geo. W. Wright as *V. delphinifolia* Nutt.* in the Flora of Richmond County.†

* Proc. Nat. Sci. Assoc. S. I. **8**: 39. 10 My 1902.
† By Arthur Hollick and N. L. Britton. Staten Island, 1879.

3. V. PECTINATA Bicknell, Torreya **4**: 129. 30 S 1904; Bull. Torrey Club **32**: 255. *pl. 18*. 27 My 1905

Midland Beach, Sept. 2, 1909 (*6012*). The leaves of these plants need not be confused with the merely toothed leaves that may be developed in the latter part of the season on *V. Brittoniana* hybrids, for the teeth or incisions are regular and distinctive and not irregular or ragged as in the hybrids.

This is a new locality for this species, only four localities having been previously reported.

4. V. CUCULLATA Ait. Hort. Kew. **3**: 228. 1789

Common. A form with bright lavender flowers has been found in a wet grassy dell in the Bloodroot Valley woods, collected June 4, 1905 (*3792*), etc.; also along Moravian Brook, near Red Lane, May 25, 1895, *Wm. T. Davis*.

5. V. EMARGINATA (Nutt.) Le Conte

V. sagittata emarginata Nutt. Gen. **1**: 147. 1818.
V. emarginata Le Conte, Ann. Lyc. N. Y. **2**: 142. 1828.

Found in a piece of woodland bordering South New York No. 3 (Darcey's woods), Aug. 14, 1907 (*5084*), Sept. 19, 1908 (*5575*), Aug. 14, 1909 (*5978*); in the meadow on the east side of Bradley Avenue, May 23, 1909 (*5648*), June 19 (*5716*), Aug. 7 (*5905*), and Aug. 14 (*5963*).

The *V. emarginata* reported in Proc. Nat. Sci. Assoc. S. I. **8**: 39. 10 My 1902, is based on *V. fimbriatula* hybrids, collected by Arthur Hollick, Sept. 23, 1883, on Todt Hill, and May 12, 1890, in the Clove Valley.

This is an extension of the range of the species.

6. V. SAGITTATA Ait. Hort. Kew. **3**: 287. 1789

Common, but not so well represented in earlier collections. The earliest record I find is Brighton Avenue woods, May 26, 1883, *C. O. Thompson*.

7. V. FIMBRIATULA J. E. Sm. Rees Cyclop. no. 38. 1817

V. ovata Nutt. Gen. **1**: 148. 1818.
V. sagittata ovata T. & G. Fl. N. A. **1**: 133. 1838.

This is common, but often mixed with *V. sagittata*. Plants

with white flowers have been found near Little Clove Road, May 13, 1904 (*2838*), and Bloodroot Valley, May 6, 1905 (*3691*).

Dr. Arthur Hollick has found the form with white flowers abundant at the Fox Hills golf links.

8. V. PALMATA L. Sp. Pl. 933. 1753

Frequent in woodland regions. The earliest specimen I find collected is sheet *506* in the herbarium of the S. I. Assoc. of Arts and Sciences, collected on Ocean Terrace, May, 1878, *Arthur Hollick*. This species is very variable in form of leaves and hybridizes freely, thus furnishing many puzzling forms, some of which are practically not identifiable.

9. V. TRILOBA Schwein. Am. Journ. Sci. **5**: 57. 1822

V. palmata dilatata Pollard, in Britton, Man. 635. 1905. Not Ell.

Tottenville, May 31, 1884, and Ocean Terrace, May 23, 1885, *Arthur Hollick;* Ocean Terrace, Sept. 20, 1903 (*2535*).

I have followed Dr. E. Brainerd in giving this specific rank, but am rather inclined to consider it a subspecies.

10. V. SORORIA Willd. Enum. 263. 1809

Frequent in woodland regions. Richmond Hill, July 30, 1898, *W. T. Davis;* Bradley Avenue meadow, Aug. 14, 1909 (*5969*); Egbertville, Aug. 23 (*6008*), etc.

11. V. HIRSUTULA Brainerd, Rhodora **9**: 98. 29 Je 1907

V. villosa Nutt. and recent authors, not Walter.

V. sororia LeConte, and Eaton, not Willd.

Only a few plants of this have been found, in the woods west of Egbertville, June 14, 1908 (*5322*), Oct. 3, 1908 (*5613*), May 31, 1909 (*5684*).

12. V. PAPILIONACEA Pursh, Fl. Am. Sept. **1**: 173. 1814

Abundant. A form with white flowers was found on Emerson Hill, May 18, 1907 (*4684*). This was transplanted and bore white flowers the next season. Forms with leaves purplish on the lower side are frequent in spring.

13. V. AFFINIS Le Conte, Ann. Lyc. N. Y. **2**: 138. 1826

This is quite common, but has been apparently overlooked by collectors. The only specimens I find collected by others are: Silver Lake, Sept. 2, 1883, *Arthur Hollick*, one plant mounted on sheet *555*, together with *V. blanda* and *V. pallens*, in the herbarium of the S. I. Assoc. of Arts and Sciences; Watchogue, June 9, 1907, *Wm. T. Davis*. In my own collection I have eighteen numbers, collected at various places on the island, the first of which is from the vicinity of the handkerchief factory, West New Brighton, Apr. 18, 1903 (*2016*), and the last from New Springville, July 19, 1909 (*5865*).

It may be noted here that the plants growing in the open look quite different from woodland plants, but the latter, when transplanted into the open, acquire the appearance of plants growing naturally in the open.

14. V. LANCEOLATA L. Sp. Pl. 934. 1753

Common. South Shore, May 6, 1866, *W. H. Leggett* (?); New Dorp, May 8, 1876, *N. L. Britton*.

15. V. PRIMULIFOLIA L. Sp. Pl. 934. 1753

Common. South Shore, May 6, 1866, West Side, July 22 1869, and Huguenot, Aug. 8, 1870, *W. H. Leggett*.

16. V. PALLENS (Banks) Brainerd

V. rotundifolia β pallens Banks, Prodr. **1**: 295. 1824.
V. pallens Brainerd, Rhodora **7**: 247. 31 D 1905.

Frequent. Originally included under *V. blanda*. South Side, May 6, 1866, *W. H. Leggett* (?); Rossville, May 21, 1882, *N. L. Britton*.

17. V. INCOGNITA Brainerd, Rhodora **7**: 248. 31 D 1905

Dr. E. Brainerd has pronounced a number of my specimens from Staten Island as belonging to this species, but the only specimens of which I can be reasonably sure are some collected at South New York No. 3, Aug. 14, 1909 (*5975*). The others are not like the *V. incognita* of the north woods.

18. V. BLANDA Willd. Hort. Berol. *pl. 24.* 1806

V. amoena LeConte, Ann. Lyc. N. Y. **2**: 144. 1828.
V. Leconteana G. Don, Gen. Syst. **1**: 324. 1831.
V. blanda palustriformis A. Gray, Bot. Gaz. **11**: 255. 1886.

Common about ponds and in wet places in woodlands. South Side, May 6, 1866, *W. H. Leggett* (?); Egbertville, May 8, 1876, *N. L. Britton;* Martling Pond, Sept. 17, 1904 (*3421*).

19. V. ROTUNDIFOLIA Michx. Fl. Bor.-Am. **2**: 150. 1803

"Near New Springville," July 22, 1899, *Wm. T. Davis;* same place (Bulls Head), Oct. 15, 1905 (*4292*), Apr. 29, 1906 (*4313*), June 10, 1906 (*4378*).

20. V. PUBESCENS Ait. Hort. Kew **3**: 290. 1789

Frequent. The *V. striata* in the Flora of Richmond County was reported on the authority of Geo. W. Wright, based on specimens of *V. pubescens* collected at Garretsons, May 27, 1876, and at West New Brighton, May 15, 1879, *N. L. Britton;* also at Silver Lake, April 28, 1878, *Arthur Hollick.*

21. V. SCABRIUSCULA (T. & G.) Schwein.

V. pubescens scabriuscula T. & G. Fl. N. Am. **1**: 142. 1838.
V. scabriuscula Schwein. T. & G. Fl. N. Am. **1**: 142. 1838.

Frequent. Barrett's Dye Works, May 26, 1879, *Arthur Hollick.*

22. V. CONSPERSA Reichenb. Pl. Crit. **1**: 44. 1823

(?) *V. labradorica* Schrank, Denkschr. Bot. Gesell. Regensb. **2**: 12. 1818.
V. Muhlenbergii Torr. Fl. U. S. **1**: 256. 1824.
V. canina Muhlenbergii Traut. Act. Hort. Petr. **5**: 28. 1877.

Reported as *V. canina sylvestris* Regel in Flora of Richmond County. Frequent in low ground in woodland regions. Clove Lake, May 14, 1876, *N. L. Britton.*

HYBRIDS, ARRANGED IN ALPHABETIC ORDER

23. **Viola affinis** × **Brittoniana** hyb. nov.

Glabrous, excepting a slight puberulence on the upper surface and margin of leaf. Blade of leaf deltoid, with a broad shallow

sinus, 2.5–7 cm. long and the later leaves as broad, on petioles two or three times as long; margin cut about midway to the mid-vein into falcate lobes, the basal lobes broad and incised, the median lobe terminating the blade with a blunt apex. Scapes of blue flowers about equaling the petioles; auricles of calyx ciliolate, short and appressed or long and spreading; cleistogamous capsules green or purplish, finely puberulent or glabrate, about 1 cm. long, on ascending or erect slender peduncles about half as long as the petioles; seeds buff. (PLATE II.)

In their vernal stage these plants resemble *Viola Brittoniana*, but the leaves are less deeply cut. The long-auricled calyx of the cleistogamous flowers shows also the relationship to this species. On the other hand the purple-mottled and puberulent capsules are unmistakable evidence of the relationship to *V. affinis*.

South Avenue, near Lambert Lane, June 9, 1907 (*4768*, type), transplanted and grown in garden for two seasons; Palmer Tract, Port Richmond, May 8, 1906 (*4321*), transplanted and grown for three seasons; near pond on South Avenue, May 29, 1909, transplanted and specimens taken June 20 (*5736*) and Aug. 12 (*5951*); Bradley Avenue, Aug. 7, 1909 (*5903*), also transplanted.

24. V. AFFINIS × CUCULLATA Brainerd, Rhodora **8**: 49. 27 Mr 1906

South New York No. 3, Sept. 19, 1908 (*5574a*); Egbertville, May 9, 1908, transplanted and specimens taken Sept. 26 (*5600*). Here probably belong also: Bradley Avenue, May 21, 1905 (*3728*), and Merrell Avenue and South Avenue, May 6, 1906 (*4318*).

25. **Viola affinis × fimbriatula** hyb. nov.

Young plants pubescent, older plants much less pubescent. Vernal leaf-blades oblong-ovate to broadly ovate, obtuse or acutish, subcordate or truncate, crenate, or irregularly toothed toward the base, densely ciliolate, 2.5–4 cm. long, 1.5–3 cm. wide, on slender petioles two to three times as long; aestival leaves deltoid to ovate, with the apex more acute, 3–9 cm. long, 2.5–6 cm. wide. Blue flowers overtopping the leaves, their calyx-lobes short and blunt, ciliolate, with short appressed ciliolate auricles; cleistogamous flowers sagittate, with longer and more spreading ciliolate auricles, on erect or ascending peduncles; capsules green or mottled with purple, puberulent or glabrous, 6–11 mm. long, in some plants entirely sterile; seeds buff to brown. (PLATE 12.)

Young plants resemble the corresponding cross with *V. papilionacea;* older plants show more the leaf character of *V. affinis.*

Emerson Hill, May 18, 1907 (*4683*, type), transplanted and specimens again taken Sept. 29 (*5239*); South New York No. 3 (Darcey's woods), May 11, 1907 (*4672*), transplanted and specimens again taken Sept. 29, 1907 (*5235*), and Aug. 6, 1909 (*5897*); Ocean Terrace, May 25, 1907 (*4713*), transplanted and specimens again taken Sept. 29 (*5243*); Egbertville, Oct. 3, 1908 (*5617*); New Springville, July 19, 1909 (*5866*).

26. **Viola affinis** × **hirsutula** nom. nov.

V. affinis × *villosa* Brainerd, Rhodora **8**: 56. 27 Mr 1906.

Rootstock fleshy, erect. Plant rather low, glabrous except the upper surface and margin of leaf, which has the characteristic pubescence of *V. hirsutula.* Blades of leaves broadly ovate to deltoid-ovate, acutish, but with a blunt tip, deeply cordate to nearly truncate at the base, 4–9 cm. long, 3.5–5 cm. wide, on slender petioles about twice their length, margin crenate-serrate with low teeth. Ripe but rather infertile capsule glabrous, about 7 mm. long.

Only one little plant of this was found on the island, in the woods west of Egbertville, Aug. 23, 1909 (*6005*). This was in the little patch of *V. hirsutula*, with plenty of *V. affinis* growing near.

The change in the name of the hybrid is due to the fact that *V. hirsutula* Brainerd takes the place of *V. villosa* of authors, not Walt.

27. **Viola affinis** × **palmata** hyb. nov.

Plant with scattered pubescence, intermediate in general appearance between the woodland form of *V. affinis* and *V. palmata.* Rootstock rather slender. Blades of leaves broadly triangular-ovate, 6–9 cm. long, 7–10 cm. wide in fully developed leaves, on slender petioles two to three times as long; apex obtusish, base with a broad sinus; margin ciliolate, irregularly toothed or shallowly lobed. Cleistogamous capsules purple-mottled, slightly puberulent, about 7 mm. long, on short ascending peduncles; calyx-lobes purplish, short, blunt, with short ciliolate auricles; seeds brown. (PLATE 13.)

One small colony was found in the woods west of Egbertville, Oct. 3, 1908 (*5615*), and one plant removed to my garden.

28. V. AFFINIS × PAPILIONACEA House, Rhodora **8**: 119. 28 Jl 1906

Richmond, July 11, 1906 (*4487*); Palmer Tract, Port Richmond, May 18, 1907 (*4682*), transplanted and specimens collected Sept. 29, 1907 (*5238*), and Aug. 6, 1909 (*5900*); South New York No. 3, Aug. 14, 1909 (*5979*, *5980*), and Oct. 2, 1909 (*6071*). Probably also: Egbertville, July 3, 1907 (*5006a*), and Aug. 23, 1909 (*6003a*); Bradley Avenue, Aug. 14, 1909 (*5968*).

29. V. AFFINIS × SAGITTATA Brainerd, Rhodora **8**: 55. 27 Mr 1906

Palmer Tract, Port Richmond, May 18, 1907 (*4681*), transplanted and specimens collected Sept. 29 (*5237*); May 15, 1909, transplanted and specimens collected Aug. 6 (*5899*) and Aug. 12 (*5953*, *5954*). A specimen collected in a meadow west of Richmond, Aug. 23, 1909 (*6001*), probably belongs here.

30. V. AFFINIS × SORORIA Brainerd, Rhodora **6**: 221. 30 N 1904

Egbertville, May 31, 1909 (*5681a*), and Aug. 23 (*6004*); Bradley Avenue, Aug. 14, 1909 (*5968*).

31. V. BRITTONIANA × CUCULLATA House, Bull. Torrey Club **32**: 255. *pl. 17*. 27 My 1905

V. notabilis Bicknell, Torreya **4**: 131. 30 S 1904.

V. cucullata × *septemloba* Brainerd, Rhodora **8**: 52. 27 Mr 1906.

Palmer Tract, Port Richmond, May 8, 1906 (*4321*); New Dorp, June 8, 1907 (*4750*), transplanted and specimens again taken Sept. 29, 1907 (*5248*); Bradley Avenue, May 23, 1909 (*5656*), transplanted and specimens again taken Aug. 12 (*5952*). Collected also at New Dorp ("Meadow near Egypt Island"), June 8, 1907, *Wm. T. Davis*, at the same time and place as my *4750*.

32. **Viola Brittoniana** × **fimbriatula** nom. nov.

V. Mulfordae Pollard, Proc. Biol. Soc. Wash. **15**: 203. 1902.

V. fimbriatula × *septemloba* Brainerd, Rhodora **8**: 51. 27 Mr 1906.

Vernal plants resembling *V. Brittoniana;* differing in having peduncles and petioles pubescent, calyx-lobes ciliolate, middle lobe of leaf longer. Aestival plants differing from *V. Brittoniana* in having larger leaves, with the middle lobe prominent, blades pubescent, on petioles about twice as long as blades. Cleistogamous capsules green, 12 mm. long, with some of the ovules abortive; seeds brown.

New Dorp, May, 1893, *N. L. Britton;* June 8, 1907 (*4751*); Bradley Avenue, May 23, 1909 (*5657*), transplanted and specimens again taken Aug. 12 (*5955*).

The change in name is due to the fact that *V. Brittoniana* takes the place of *V. septemloba* of authors, not LeConte.

33. **Viola Brittoniana × papilionacea** hyb. nov.

Slightly pubescent on the upper surface and margin of leaves, otherwise glabrous, 1.5–3 dm. tall. Rootstock fleshy, short, erect or ascending. Vernal leaves purplish beneath, ovate, obtuse, crenate or lobed; aestival leaves ovate to broadly triangular-ovate, irregularly toothed, or cut into falcate toothed or incised lobes, apex acute or obtuse, base cordate to truncate, blades 4–8 cm. long, 3–11 cm. wide, on petioles about three times as long. Petaliferous flowers large, the beard on lateral petals not strongly knobbed, peduncles equaling or shorter than the petioles; cleistogamous flowers sagittate, on short decumbent or ascending peduncles; capsules greenish, mottled with purple, about 1 cm. long; seeds as in *V. Brittoniana.* (PLATE 14.)

In its vernal stages it resembles the corresponding crosses with *V. affinis* and *V. cucullata*, but later its cleistogenes serve to determine its relationship without doubt. A large vigorous clump was found in a meadow on the east side of Bradley Avenue, May 23, 1909 (*5658*), transplanted, and specimens collected July 24 (*5892*), Aug. 6 (*5901*), and Aug. 12 (*5950*, PLATE 14). A small plant was found at Great Kills, May 8, 1909, transplanted and specimens taken Aug. 12 (*5949*). The latter differs from the Bradley Avenue specimens in its smaller size, the later leaves less deeply cut, the calyx-lobes and auricles shorter, the capsules more purple, and the seeds dark, thus more approaching *V. papilionacea* in its later stage; while in its early stage it showed no marked differences from the other plants, except its smaller size.

34. V. BRITTONIANA × SAGITTATA House, Rhodora **8**: 120. 28 Jl 1906

V. sagittata × *septemloba* Brainerd, Rhodora **8**: 51. *pl. 66.* 27 Mr 1906.

Oakwood, Sept. 1897, *N. L. Britton;* New Dorp, near foot of New Dorp Lane, July 29, 1899, and June 8, 1907, *Wm. T. Davis;* New Dorp (with Wm. T. Davis), June 8, 1907 (*4749*); Midland Beach, Sept. 2, 1909 (*6010*); Palmer Tract, Port Richmond, May 17, 1909, transplanted and specimens taken Sept. 12 (*6040*).

35. V. CUCULLATA × FIMBRIATULA Brainerd, Rhodora **6**: 217. 30 N 1904

V. Porteriana Pollard, Bull. Torrey Club **24**: 404. 1897.

Tottenville, Sept. 18, 1898, and Aug. 6, 1899, *Wm. T. Davis;* Bradley Avenue, May 21, 1907 (*4705*), transplanted and specimens taken Sept. 29, 1907 (*5241*); Little Clove Road, June 15, 1907 (*4779a*); Bradley Avenue, Sept. 13, 1908 (*5568*).

36. V. CUCULLATA × PALMATA Brainerd, Rhodora **8**: 56. 27 Mr 1906

Bradley Avenue woods, May 17, 1908 (*5307*), and May 23, 1909 (*5654*); Todt Hill, June 12, 1909 (*5697*).

When we recognize *V. triloba* as a species, these should be classed as *Viola cucullata* × *triloba.*

37. V. CUCULLATA × PAPILIONACEA Brainerd, Rhodora **8**: 56. 27 Mr 1906

Ocean Terrace, May 25, 1907 (*4716*).

38. V. EMARGINATA × FIMBRIATULA Brainerd, Rhodora **8**: 57. 27 Mr 1906

South New York No. 3 (Darcey's woods), Aug. 14, 1907 (*5085*); Bradley Avenue, Aug. 14, 1909 (*5961, 5965*).

39. V. EMARGINATA × SAGITTATA Brainerd, Rhodora **8**: 58. 27 Mr 1906

Bradley Avenue, Aug. 14, 1909 (*5957–5959*).

40. **Viola fimbriatula × hirsutula** nom. nov.

V. fimbriatula × *villosa* House, Rhodora 8: 121. 28 Jl 1906.

Plant pubescent, low, with erect or ascending rootstock. Leaf-blades thick and firm, dark green above, ovate, acute, cordate, crenate-serrate, ciliate and appressed-pubescent, with the characteristic hairs of *V. hirsutula* on the upper surface; petioles one to two times as long as the blades. The imperfectly developed cleistogenes sagittate, small, on short decumbent or ascending puberulent peduncles; calyx-lobes purplish, lanceolate, with rather long ciliolate auricles. (PLATE 15.)

Woods west of Egbertville, in the *V. hirsutula* patch, Aug. 23, 1909 (*6007*).

41. V. FIMBRIATULA × PALMATA Robinson, Rhodora 8: 53. 27 Mr 1906

Ocean Terrace, May 25, 1907 (*4712*); Bradley Avenue woods, May 17, 1908 (*5309a*).

42. V. FIMBRIATULA × PAPILIONACEA Brainerd, Rhodora 8: 54. 27 Mr 1906

Iron Mines, Jewett Avenue, Apr. 25, 1903 (*2021*); Ocean Terrace, Apr. 26, 1903 (*2038*), May 18, 1906 (*4516a*), May 25, 1907 (*4715*), the last transplanted and specimens taken Sept. 29, 1907 (*5245*); Little Clove Road, May 3, 1907, transplanted and specimens collected Oct. 13, 1907 (*5281*); Little Clove Road June 15, 1907 (*4776*).

43. V. FIMBRIATULA × SAGITTATA Brainerd, Rhodora 8: 57. 27 Mr 1906

Rossville, Aug. 6, 1869, *W. H. Leggett* (*?*); Court House, May 10, 1879, *N. L. Britton;* Ocean Terrace, May 10, 1879, *Arthur Hollick*. Common with the putative parents. Where the two species grow together it is difficult to find the pure species unmixed; they cross freely, and the hybrids show marked fertility.

44. V. FIMBRIATULA × SORORIA Brainerd, Rhodora 6: 218. 30 N 1904

New Dorp, June 3, 1897, *A. A. Tyler*; Grasmere, May 29, 1907 (*4720*), transplanted and specimens taken Sept. 29, 1907 (*5246*).

45. V. HIRSUTULA × PAPILIONACEA Brainerd, Rhodora 9: 98. 29 Je 1907

V. papilionacea × *villosa* House, Rhodora 8: 121. 28 Jl 1906.
? *V. villosa cordifolia* Nutt. Gen. 148. 1818.
? *V. cordifolia* Schwein. Am. Jour. Sci. I. 5: 62. 1822.
? *V. villosa cordata* Torr. Fl. U. S. 1: 252. 1824.

Egbertville, June 14, 1908 (*5322a*), Oct. 3, 1908 (*5611* and *5612*), transplanted and specimens taken Aug. 12, 1909 (*5956*).

46. **Viola hirsutula × sororia** hyb. nov.

Dark green, pubescent, 2 dm. tall. Leaf-blades broadly ovate, obtuse, cordate or somewhat reniform, upper surface appressed-pubescent with the characteristic hairs of *V. hirsutula*, lower surface pubescent on the veins; margin ciliate, crenate; petioles ascending, pubescent, one to three times as long as the blades. Cleistogenes not fully developed, small, on prostrate or decumbent peduncles; calyx purplish, with short ciliolate auricles. (PLATE 16.)

This resembles the corresponding cross with *V. papilionacea*, differing chiefly in having pubescent petioles and lower surfaces of leaves. A small colony was found in the *V. hirsutula* patch at Egbertville, May 31, 1909 (*5682*, type), and one plant transferred to my garden.

47. **Viola lanceolata × primulifolia** hyb. nov.

Plant taller and more slender than *V. primulifolia*, and in general appearance intermediate between this and *V. lanceolata*. Leaf-blades ovate to lanceolate, acute or obtuse, decurrent on the petiole, margin crenate with low teeth, the points of which are incurved. Early flowers on long slender peduncles equal to or longer than the petioles; capsules green, about 8 mm. long; seeds brown. (PLATE 17.)

Plants collected at Grasmere, May 29, 1907 (*4723*, type), and some transplanted at home, showed the same intermediate character at the end of the season, with a general appearance more like *V. lanceolata* at the end of the season. Other specimens were found on South Avenue, June 9, 1907 (*4760*), transplanted and specimens again taken Sept. 29, 1907 (*5249*); also at Watchogue, Sept. 20, 1908 (*5585*), and from transplanted material Aug. 6, 1909 (*5898*). To this hybrid belong probably also: Tottenville, Sept. 9, 1868, *W. H. Leggett* (?); Watchogue, Sept. 30,

1883, *Arthur Hollick* (sheets *561*, *562*, and *572* in the herbarium of the Staten Island Association of Arts and Sciences); Woodrow, June 22, 1907, *Wm. T. Davis*.

48. **Viola pallens × primulifolia** hyb. nov.

Freely stoloniferous, pubescent on the peduncles and petioles, about 2 dm. tall. Leaf-blades pale beneath, ovate, acute or obtuse, subcordate to cordate, crenate with low incurved teeth, 4–6 cm. long and 3.5–5 cm. wide in mature leaves, sometimes as wide as long, on petioles about three times as long. White flowers on long slender peduncles equaling or longer than the petioles; capsules green, 5–8 mm. long; seeds small and dark. (PLATE 18.)

The specimen shown in the plate was taken from my garden Sept. 22, 1908 (*5596*), after having been transplanted from South Avenue, July 25, 1907 (*5059*). This shows a marked resemblance to *V. primulifolia*, and would probably have been so labeled without closer study. It differs from this in its shorter, more ovate and cordate leaf-blades, and in its small dark seeds characteristic of *V. pallens*. Other specimens are: Bulls Head, Aug. 18, 1906 (*4576*); Merrell Avenue, near South Avenue, Sept. 16, 1906 (*4621*), and June 9, 1907 (*4759*); South New York No. 3 (Darcey's woods), May 11, 1907 (*4670*), Aug. 14, 1907 (*5086*), and Oct. 2, 1909 (*6067*); South Avenue near Arlington, June 9, 1907 (*4764*), and from transplanted material Sept. 29, 1907 (*5250*); woods between South Avenue and the fireworks factories at Bulls Head, Sept. 8, 1907 (*5196*); Bradley Avenue, Aug. 14, 1909 (*5972*). Here probably belong also: Watchogue, May 11, 1884, *Arthur Hollick* (sheet *553*); Graniteville, July 16, 1898, *Wm. T. Davis*.

49. **Viola palmata × papilionacea** Brainerd, in herb., hyb. nov.

This differs from *V. palmata* in the direction of *V. papilionacea* by the more entire leaves, its scant pubescence, smaller flowers on shorter peduncles, while it resembles *V. palmata* in having irregular shallow lobes on the leaves, the veins prominent, and being more or less pubescent.

Specimens can not be assigned here with absolute certainty on account of the similarity in the fruit of *V. palmata*, *V. papilionacea*, *V. sororia*, and *V. triloba*, but I believe the following belong here: Ocean Terrace, May 23, 1903 (*2127*); Little Clove Road,

toward Ocean Terrace, May 13, 1904 (*2839*), and June 15, 1907 (*4777*).

50. V. PALMATA × SAGITTATA Brainerd, Rhodora **8**: 54. 27 Mr 1906

Middletown Forest, June 4, 1905 (*3791*); Bradley Avenue woods, May 21, 1907 (*4706*), transplanted and specimens collected Sept. 29, 1907 (*5242*); Bloodroot Valley woods, Aug. 13, 1907 (*5083*); Egbertville, Oct. 26, 1907 (*5292*), and June 14, 1908 (*5321*).

51. V. PAPILIONACEA × SAGITTATA Brainerd, Rhodora **8**: 54. 27 Mr 1906

Palmer Tract, Port Richmond, May 18, 1907 (*4681*), transplanted and specimens taken June 20, 1909 (*5735*); Emerson Hill, May 18, 1907 (*4687*).

52. **Viola papilionacea** × **sororia** Brainerd, in herb., hyb. nov.

This differs from *V. sororia* in having longer petioles, thinner leaves, and less pubescence, while it differs from *V. papilionacea* in being decidedly more or less pubescent.

Here are placed the following: Grasmere, May 29, 1907 (*4721*); transplanted and specimens taken Sept. 29, 1907 (*5247*); Emerson Hill, May 18, 1907 (*4685*, *4686*); Egbertville, May 31, 1909 (*5681*).

This list does not include all the violet hybrids growing on Staten Island, for I have in cultivation some suspected hybrids, the exact identity of which is not definitely established; but the above list of thirty hybrids is perhaps longer than would be expected. It is not surprising, however, to find so many hybrids, when we consider the fact that the trees are being cut down in the woodlands and the natural surroundings of the plants continually disturbed. It seems that under the changed conditions they hybridize more freely. In this connection it is interesting to note that while it is difficult to find typical *V. hirsutula*, several of its hybrids have been found growing in its immediate vicinity.

The large number of species found on so restricted an area is partly accounted for by the fact that the terminal moraine crosses

the island and that there are thus two life zones represented. Attention may here be called to *V. rotundifolia* as a remnant of mountain flora growing in the lowlands between Bulls Head and New Springville. In this connection may be mentioned also *Aster acuminatus* Michx., which grows in the same place, near Bulls Head, and at two other places in the low woods towards the west and south.

Since Staten Island is a part of Greater New York, and real estate improvements are continually encroaching on nature, some of the species are scarce, and the localities in which they are found may soon be used for city lots. Thus these species may be exterminated from the island, and their occurrence here will be chiefly of historical interest.

PORT RICHMOND, N. Y.

Explanation of plates 11-18

PLATE 11

Viola affinis × *Britteniana* Dowell, × ⅔; *a*, plant collected June 9 (*no. 4768*); *b*, leaf and capsule from specimen collected June 20 (*no. 5736*); *c*, leaf from same plant Aug. 12 (*no. 5951*).

PLATE 12

Viola affinis × *fimbriatula* Dowell; *a*, plant collected May 18 (*no. 4683*); *b* and *c*, leaf and capsule from plant grown in garden, collected Sept. 29 (*no. 5239*); *a* and *b* × ⅝, *c* × ¾.

PLATE 13

Viola affinis × *palmata* Dowell, × ⅔. (*No. 5615.*)

PLATE 14

Viola Brittoniana × *papilionacea* Dowell, × ½. (*No. 5950.*)

PLATE 15

Viola fimbriatula × *hirsutula* Dowell, × ⅔. (*No. 6007.*)

PLATE 16

Viola hirsutula × *sororia* Dowell, × ⅔. (*No. 5682.*)

PLATE 17

Viola lanceolata × *primulifolia* Dowell, natural size; *a*, plant collected May 29 (*no. 4723*); *b*, *c*, leaf and capsule from plant grown in garden, Sept. 29.

PLATE 18

Viola pallens × *primulifolia* Dowell, × ⅔. (*No. 5596.*)

Contributions to the Mesozoic flora of the Atlantic coastal plain — V.* North Carolina

EDWARD W. BERRY

(WITH PLATES 19–24)

In a brief communication by the writer published in 1907,† twenty-nine species of fossil plants were recorded from the Mid-Cretaceous deposits of North Carolina. Subsequently, *Tumion carolinianum* ‡ as well as two species of *Araucaria* § were deemed to be worthy of special description. The present paper adds twenty-nine species to this flora, bringing the total number of known forms up to sixty-one. These are all contained in the Black Creek formation and are of Mid-Cretaceous age, *i. e.*, somewhere in the lower half of the Upper Cretaceous. Continued exploration by Dr. L. W. Stephenson and the writer has increased the number of localities where Cretaceous plants have been found from four to twenty-five, all of which were unknown previous to 1907. The flora is not large and probably not more than a dozen or fifteen species will be added to it when the collections in hand are fully studied. It offers many interesting physical and biological problems which will be discussed in detail in a fully illustrated report upon this flora now in course of preparation for the North Carolina Geological Survey.

In the first contribution to this flora allusion was made to the striking absence of representatives of the class Gymnospermae, only one *Sequoia* having been recorded at that time and that one but sparingly represented. The present contribution increases the number of Gymnosperms to fifteen, which include two members of the order Cycadales and thirteen of the order Pinales. The family Taxaceae has one or more species and the remaining spe-

* Published by permission of the Director of the U. S. Geological Survey, and the North Carolina Geological Survey.

† Berry, Bull. Torrey Club **34**: 185–206. *pl. 11–16.* 1907.

‡ Berry, Amer. Jour. Sci. IV. **25**: 382–386. *f. 1–3.* 1908.

§ Berry, Bull. Torrey Club **35**: 219–260. *pl. 11–16* + *f. 1, 2.* 1908.

cies are distributed as follows among the subfamilies of the Pinaceae: Araucarieae six species, Taxodieae four, Cupresseae one, and Abieteae one. Attention was called, also, to the absence of species of *Laurus* and *Salix* in the previous collections and the prediction was made that they would probably be found eventually. This prediction is now fulfilled, four species of *Salix* and two lauraceous forms being recorded on the following pages.

CYCADALES

PODOZAMITES KNOWLTONI Berry, Bull. Torrey Club **36**: 247. 1909

Podozamites angustifolius (Eichw.) Schimp. Pal. Végét. **2**: 160. 1870. Not Schenk, 1868.

This species was characterized by the writer in a recent issue of the BULLETIN. The North Carolina specimens are abundant but somewhat fragmentary at the Rockfish Creek locality and what is probably the same species, but too poorly preserved for certainty, occurs at the 92 mile-post on the Neuse River.

OCCURRENCE: Rockfish Creek near Hope Mills.

CYCADINOCARPUS CIRCULARIS Newb. Fl. Amboy Clays 46. *pl. 46. f. 1–4.* 1896

These supposed cycad-fruits are abundant in the Raritan formation of New Jersey and have been reported also from the Tuscaloosa formation of Alabama. They always occur as detached impressions but are well characterized and easily recognized.

OCCURRENCE: Big Bend, Black River.

PINALES

Araucaria Clarkii sp. nov.

Scale short and stout, broadly ovate, the body 12 mm. long and 9 mm. wide, not alate. Apex produced into a narrow recurved spine 3 mm. to 4 mm. in length. The enclosed seed, which is preserved in the type specimen, is obovate in outline, 4 mm. long and about 2.5 mm. wide.

This species is based upon a single specimen which is, however, clearly distinct from the large cone-scales of *Araucaria Jeffreyi* Berry, which are so common in the Black River Cretaceous out-

crops, and furnishes confirmatory evidence of the variety and abundance of the Araucarieae in our southern coastal plain during the first half of the Upper Cretaceous.

The present species is named for Prof. William B. Clark, geologist in charge of the coöperative investigations of the coastal plain in North Carolina.

OCCURRENCE: Court House Bluff, Cape Fear River.

BRACHYPHYLLUM MACROCARPUM Newb. (?) Fl. Amboy Clays 51 (footnote). *pl. 7. f. 1–7.* 1896

This species was collected by the writer on July 13, 1907, but the specimens were destroyed during shipment, for which reason the occurrence is queried, although there is no doubt as to its authenticity, especially as the writer has recently collected it a short distance south of the state boundary in South Carolina.

OCCURRENCE: Court House Bluff, Cape Fear River.

Androvettia carolinensis sp. nov.

Remains of leafy twigs consisting of much flattened, phylloclad-like, opposite twigs, the leaves on the flat surfaces being reduced to mere points and not visible without magnification, the marginal leaves strictly opposite and represented by a regular alternation of a blunt dentate lobe and a serrate point, the leaves being fused proximally. Venation consisting of immersed vascular bundles not seen except in a strong transmitted light. Midvein strong and straight; lateral veins, which are the midveins of the coalesced leaves, pinnately arranged and single in the pointed leaves; in the rounded leaves they are usually dichotomously forked but in this case the marginal lobes may represent two coalesced leaves; their angle of divergence greater than in *Androvettia statenensis* and the whole arrangement more distinctly cyclic in character. Texture very coriaceous, the epidermal cells, however, large, though with thick walls. Stomata fairly numerous, apparently on both surfaces, and consisting of sausage-shaped guard cells surrounded by four accessory cells. (PLATE 19, FIGURES 1–6.)

The general appearance of this species is even more fern-like than in the type of the genus, one reason being its smaller size and the absence in the collected material of the supposed male aments found in connection with some specimens of the Staten Island species. The present species is confined to the Tar River exposures of the Black Creek beds and is therefore considerably younger than the Staten Island form.

This remarkable genus was erected by Hollick and Jeffrey * for the reception of a single species discovered recently in the Upper Raritan deposits near Kreischerville, Staten Island, and the writers content themselves with a very good account of this species and refrain from framing a generic diagnosis. This laudable conservatism is abundantly justified by the writer's discovery of two additional species that cannot be generically separated from the Staten Island species and furnish a number of additional characters which serve to isolate this genus.

These remains are all entirely fern-like in superficial appearance, uniformly coriaceous in texture, and by the details of their external characters and internal structure are indubitable gymnosperms of the order Pinales. Their positive reference to the Araucarineae by Hollick and Jeffrey will, however, undoubtedly be questioned by many students. The North Carolina remains are not common and are confined to a single locality on the Tar River. The lateral leaves along the edges of phylloclad-like twigs are markedly opposite, while the scale leaves on its flat surfaces are much more reduced than in *Androvettia statenensis* and cannot be made out at all except in microscopical preparations of the epidermis, in which they are seen to be reduced to mere points of termination of certain leaf-traces. The lateral twigs are strictly opposite as is the course of the vascular bundles, which consist of a regular alternation of opposite simple bundles and dichotomously forked bundles. The remains from Georgia, previously mentioned, vary from *Androvettia statenensis* in the other direction and scarcely merit the term phylloclad-like; the leaves, both marginal and surficial, are opposite and well developed, very regular, with a vascular arrangement like that of the Carolina form. They are distichous and opposite on a naked stem, which is thus more fern-like in appearance than either of the other two species. Since the anatomy of these forms has not yet been studied, the reader is referred to the memoir cited above, where the histology of the Staten Island form is discussed.

Regarding the systematic position of this genus, as already remarked, its relationship with the Araucarian group of conifers is questionable. It seems clearly distinct from *Phyllocladus* and

* Mem. N. Y. Bot. Gard. 3: 22. 1909.

it is equally distinct from the various species of *Protophyllocladus* which have been recorded from the Raritan and later Cretaceous formations of North America. It seems equally distinct from *Thinnfeldia* but may possibly prove to be related to *Moriconia*. The comparisons of *Androvettia statenensis* with the Lower Cretaceous species *Ctenopteris insignis*, *Zamiopsis insignis*, *Thinnfeldia marylandicum* and *Plantaginopsis marylandica* are singularly unhappy. The writer will show in another place that the last two are monocotyledons and the others either ferns or cycads and not even remotely related to the forms under discussion.

OCCURRENCE: Three miles below Dunbars Bridge, Tar River, Edgecombe County.

DAMMARA BOREALIS Heer (?), Fl. Foss. Arct. **6**[2]: 54. *pl. 37. f. 5.* 1882

This species was collected at the same time as the *Brachyphyllum* referred to above and was likewise destroyed during shipment and is consequently queried, although there can be little doubt but that the specimens were of this species, which is so abundant at homotaxial horizons to the northward. It has also been discovered recently by the writer to the southward of North Carolina in the Tuscaloosa formation of Alabama.

OCCURRENCE: Court House Bluff, Cape Fear River.

SEQUOIA REICHENBACHI (Gein.) Heer, Fl. Foss. Arct. **1**: 83. *pl. 43. f. 1d, 2, 5a.* 1868

Characteristic twigs of this widespread Mesozoic conifer occur at a number of localities in North Carolina. They are indistinguishable from the similar remains so common at a large number of localities in the Atlantic coastal plain.

OCCURRENCE: Rockfish Creek near Hope Mills; Parker Landing, Tar River; 92 mile-post, Neuse River.

SEQUOIA MINOR Velen. Sitz. K. Böhm. Gesell. **1886**: 638. *f. 11–13.* 1887

This species, which was described by Velenovsky from the Cenomanian of Bohemia and based on cone-bearing twigs, is new to the American flora unless possibly the specimen from the New

Jersey Raritan which Newberry identified as *Thuites Meriani* Heer is to be correlated with it.

OCCURRENCE: Big Bend, Black River; Parker Landing, Tar River.

CUNNINGHAMITES ELEGANS (Corda) Endl. Synop. Conif. 305. 1847.
— Newb. Fl. Amboy Clays 48. *pl. 5. f. 1–7.* 1896

This handsome species characterizes the Cenomanian and Senonian floras of Europe and the Magothy formation of eastern North America. Although Newberry is cited above, this species does not occur in the Raritan formation, his specimens having almost certainly come from the overlying Magothy formation.

As may be seen from the figures (PLATE 20, FIGURES 1–4), the North Carolina material is abundant and shows the characteristic leaf-scars of this species. The North Carolina forms are much more robust than any other specimens known to the writer, some of the leaves being 6.5 cm. in length and 4 mm. in width, so that it may be desirable eventually to consider them as representing a variety. However, as the usual size occurs sparingly in association with the larger examples it seems probable that both were borne by the same trees.

OCCURRENCE: Corbits Bridge, Horrell Landing, Sykes Landing, A. C. L. Bridge, Black River.

MORICONIA AMERICANA Berry, Bull. Torrey Club **37**: 20. 1910

This Upper Cretaceous conifer is confined to the Bladen and homataxial horizons of the Atlantic coastal plain with a recorded range from New Jersey to South Carolina. The geometrical impressions of its symmetrical leafy twigs with their semicircular appressed leaves is so characteristic that the merest fragment is readily identifiable, even by a novice. (PLATE 20, FIGURE 5.)

OCCURRENCE: Elizabethtown, Cape Fear River.

Cephalotaxospermum gen. nov.

Fruits solitary (?), sessile or with an extremely short and stout peduncle, ovoid, somewhat pointed apically and inclined to become slightly cordate below, consisting of an outer fleshy layer and an inner bony layer, as in the Cycadales and Ginkgoales; its

surface mammillated much as in *Podocarpus elongata* but less markedly so. Bony endocarp ovate-acuminate, immersed in the apical part of the exocarp. Evidently the drupaceous fruits of some Cretaceous member of the Taxaceae which finds its closest homology in the recent flora in the fruits of *Cephalotaxus* and certain species of *Podocarpus*.

Cephalotaxospermum carolinianum sp. nov.

Fruit a drupe with the following dimensions as preserved in a much flattened condition: length 6 mm. to 13 mm., averaging about 10 mm.; breadth 5 mm. to 10 mm. averaging about 8 mm.; thickness about 3 mm.; fruit in life probably almost circular in cross-section. Peduncle short and stout or wanting. Stone ovate-acuminate, lying in the apical part of the fleshy exocarp with the beaked micropylar end reaching almost or quite to the apex. As preserved in a much flattened condition in the clays, these fruits tend to split into two parts, disclosing the bony endocarp or merely a cast of its cavity. The fleshy part of the fruit is carbonized and fails to show any histological details. There is some evidence or at least a suggestion in some specimens of the remains of a micropylar canal. Away from the pointed apex, the exocarp is 1 mm. to 2 mm. in thickness reaching a thickness of 3 mm. at the chalazal end.

These fruits are very abundant at certain localities in the Black Creek formation and they have been collected also in the extension of this formation near Florence, S. C., and in the upper part of the Tuscaloosa formation in Hale County, Alabama.

Fruits referable to the Taxaceae are extremely rare in the fossil state, as are also remains of foliage which can be referred with certainty to this family. Both *Tumion* and *Cephalotaxopsis* from the Lower Cretaceous of Maryland and Virginia are founded upon foliage which seems referable with considerable certainty to this family, and these same strata in those states abound in the foliage referred to the genus *Nageiopsis*, which seems to be closely related to *Podocarpus*, so that there is considerable reason for expecting to find Upper Cretaceous representatives of the family in this same general region. Heer * describes a leafy twig from the Patoot beds (Senonian) of Greenland with a large solitary fruit which he calls *Cephalotaxites insignis*, an identification which

* Heer, Fl. Foss. Arct. 7: 10. *pl. 53. f. 12.* 1883.

Solms-Laubach * seems to consider probable. Bertrand † has described carbonized seeds from the Aachenien of Tournay, Belgium, under the name of *Vesquia Tournaisii*, which he considers, because of the arrangement of the vascular bundles, as intermediate between *Tumion* and *Cephalotaxus*. It certainly seems to be not without significance that remains of this sort occur at nearly homotaxial horizons in America, Europe, and Greenland.

None of the foregoing, however, are comparable with the present forms, although certain indefinite remains described by Lesquereux as *Inolepis* sp.,‡ are remotely suggestive of them. It is not believed, however, that they are congeneric.

The modern genus *Cephalotaxus* Sieb. & Zucc., with four species, is confined to the China-Japan region, although it seems evident that it was much more widespread in former geologic times, and to it should probably be referred some of the leafy twigs included in the genus *Taxites* Brong. Fruits of three species of *Cephalotaxus*, apparently identified correctly, are described by Kinkelin § from the upper Pliocene deposits of the Main Valley in Germany. The considerations which seem to indicate a closer relationship with *Cephalotaxus* than with *Podocarpus* are the absence of the thickened peduncle of the latter and the presence of foliage in the same beds with these seeds described by the writer as *Tumion carolinianum* || and which is of the same type as that of *Cephalotaxus* and might with propriety have been the foliage of the tree which bore the very abundant fruits here named *Cephalotaxospermum*.

OCCURRENCE: Seventy-four and three-fourths miles above Wilmington, Sykes Landing (common), Big Bend (very common), A. C. L. Bridge (very common), Corbits Bridge, all localities on the Black River in Sampson County; Parker Landing, Tar River (?).

* Solms-Laubach, Fossil Botany 61. 1891.

† Bertrand, Bull. Soc. Bot. France **30**: 293. 1883.

‡ Lesquereux, in Hayden's Ann. Rept. for 1874: 337. *pl. 4. f. 8.* 1876; Cret. and Tert. Fl. 33. *pl. 1. f. 8.* 1883.

§ Engelhardt & Kinkelin, Abh. Senckenb. Naturf. Gesell. **29**[3]: 194. *pl. 23. f. 9–13.* 1908.

|| Berry, Amer. Jour. Sci. IV. **25**: 382–386. *f. 1–3.* 1908.

PINUS RARITANENSIS Berry (?) Bull. Torrey Club **36**: 247. 1909

Leaves in fascicles of threes, undoubtedly of this species, were collected by the writer on July 13, 1907, but were destroyed during shipment so that the occurrence is queried. It is associated with amber at Martha's Vineyard, Kreischerville, Staten Island, and Morgans, N. J., and with wood of *Pityoxylon* at the two latter outcrops, so that possibly the widely disseminated amber of the North Carolina Cretaceous may owe its origin to this same species.

OCCURRENCE: Court House Bluff, Cape Fear River.

ARALES

Pistia Nordenskioldi (Heer) Berry, comb. nov.

(PLATE 21, FIGURES 1–15)

Chondrophyllum Nordenskioldi Heer, Fl. Foss. Arct. **3**[2]: 114. *pl. 30. f. 4b; pl. 32. f. 11, 12.* 1874.—Berry, Bull. Torrey Club **34**: 198. *pl. 13. f. 1.* 1907.

This species of Heer's, described originally from the Atane beds of Greenland, was identified by the writer in 1907 among the scanty materials collected at Blackmans Bluff on the upper Neuse River in 1906 but its true botanical affinity was not determined. With the discovery of additional localities during the summers of 1907 and 1908 it was found to be exceedingly abundant and its true relations began to be suspected. In its size, outline, and venation it is scarcely to be distinguished from the modern *Pistia Stratiotes* L., which is certainly a variable and widely distributed, chiefly tropical, species. In this country it is found from Florida to Texas. Elsewhere it occurs in the West Indies and southward through Mexico and Central America to Paraguay and Argentina. In Africa it is found from Natal to Senegambia and Nubia, occurring also in Madagascar and the Mascarene Islands. In Asia it occurs throughout the East Indies and northward to the Philippines.

The fossil forms are more like the younger leaves of the modern plant (possibly a phylogenetic character in the latter), the later leaves tending toward a cuneate outline with a truncated apex and straighter sides.

A remarkable feature in connection with the North Carolina fossil form is that all of the figures on PLATE 21 except FIGURES 4 and 15 are made from sun prints of the actual leaves carefully washed out of the Cretaceous clays and subsequently mounted in balsam between glass. The epidermis is preserved in some instances and the stomata will be fully described in the final report. They are few and scattered and are confined to one surface and are altogether absent from the broad leaf-bases.

But few fossil forms have been referred to this genus. Hosius and von der Marck described in 1880 what they called *Pistites loriformis* from the Lower Senonian of Westphalia (Palaeont. **26**: 182. *pl. 38. f. 151, 152*) but this is probably cycadean, as Schenk suggested (in Zittel's Handbuch 378. 1890). Lesquereux in 1876 (Ann. Rept. U. S. Geol. and Geog. Surv. Terr. 299. 1874) named a remarkably well-preserved form from Point of Rocks, Wyoming, *Pistia corrugata*. This was fully described and illustrated in his Tertiary Flora (103. *pl. 61. f. 1, 3–7, 9–11.* 1883) and included leaves of various sizes and rootlets. It comes from beds belonging to the Montana formation (Senonian), which are of about the same age as the French beds from which the only other species is known. This latter, *Pistia Mazelii* was mentioned and figured from the lignites of Fuveau (Provence), France, by Saporta and Marion in their popular work, L'évolution du règne végétal, published in 1885 (Phanérogames **2**: 37. *f. 114C, D*) and has never been adequately described.

It is significant as showing how imperfect the geological record really is, even of the European tertiaries, that this widespread modern type ranged over at least two continents during the Upper Cretaceous and presumably had a still wider range in Cenozoic times, and yet not a single specimen has ever come to light at any of the thousands of localities where plant beds of the latter age have been exploited.

OCCURRENCE: Parker Landing, Tar River; Blackmans Bluff, Neuse River; A.C.L. Bridge, Big Bend, Sykes Landing, 56⅞ miles above Wilmington, Corbits Bridge, and Horrell Landing, on the Black River.

GRAMINALES (?)

Phragmites Prattii Berry, nom. nov.

Phragmites sp. Berry, Bull. Torrey Club **34**: 190. *pl. 11. f. 5.* 1907.

The present case is an admirable instance of the undesirable practice of not giving a specific name to specimens of somewhat indefinite botanical affinity which it becomes necessary to cite frequently in subsequent work and which cannot be done intelligently when there are dozens of "*Phragmites* sp." in the literature. To remedy this deficiency the above species is named in honor of the efficient state geologist of North Carolina.

OCCURRENCE: Court House Bluff, Prospect Hall, mouth of Harrisons Creek, Cape Fear River.

MYRICALES

MYRICA CLIFFWOODENSIS Berry, Bull. Torrey Club **31**: 73. *pl. 4. f. 1.* 1904

Fruit which cannot be distinguished from that of this species, described from the Magothy formation at Cliffwood Bluff, N. J., is contained in the North Carolina collections.

OCCURRENCE: Parker Landing, Tar River.

POLYGONALES

Pisonia cretacea sp. nov.

Leaves ovate, 1.8 cm. in length by 1.3 cm. in greateat width, which is midway between the apex and the base. Apex wide and full, bluntly pointed. Base somewhat more narrowed and slightly decurrent. Petiole short and stout, about 3 or 4 mm. in length. Midrib narrowing rapidly from the base, slightly curved. Secondaries immersed. Margins entire.

This species differs from the only other Cretaceous species known, *Pisonia atavia* Velen. of Bohemia, in its relatively narrower outline, less rounded apex and longer petiole, both forms being of about the same size.

The present is the first undoubted Cretaceous species of this genus found in this country, and only one Tertiary species is known. The latter was recently collected by the writer from the upper Eocene of Georgia.

The existing species of *Pisonia* are numerous, inhabiting the tropics of both hemispheres, being largely developed in Central America and tropical South America, with several species in the West Indies and Antilles. Heimerl, in his treatment of the genus in Engler and Prantl's Natürlichen Pflanzenfamilien, divides it into six sections, some of which should undoubtedly be given generic rank, in fact Britton proposes to segregate the West Indian and Antillean species to form the genus *Torrubia* Vell., restricting *Pisonia* to the vines such as the type species, *Pisonia aculeata* L. However, in view of the foreign usage and what is more important, the geological considerations, which all point against following too closely systematists dealing only with the existing flora, especially when it is merely a question of the selection of a generic name among closely related modern forms, it is believed that a conservative course is most desirable in dealing with the fossil forms and the present new species is therefore referred to *Pisonia*.

Members of this genus are not rare as fossils, the oldest recorded species being based upon leaves from the Chlomeker sandstone near Leipa, Bohemia, and described by Velenovsky * as *Pisonia atavia*. These are of Upper Cretaceous, probably Cenomanian age, and if collected at a homotaxial horizon in this country would be referred to the genus *Persoonia* Swartz.† No other Cretaceous leaves have been referred to *Pisonia*, although Lesquereux‡ referred the only American species heretofore described, *Pisonia racemosa*, to the Laramie. Five species are recorded from the European Tertiary from beds ranging in age from the Ligurian to the Sarmatian. The present species is extremely close to *Pisonia eocenica* Ettings. from the lignites of Haering in the Tyrol, where it is represented by both leaves and fruit.

OCCURRENCE: Three miles below Dunbars Bridge, Tar River, Edgecombe County.

JUGLANDALES

JUGLANS ARCTICA Heer, Fl. Foss. Arct. 6[2]: 71. *pl. 40. f. 2; pl. 41. f. 4c; pl. 42. f. 1–3; pl. 43. f. 3.* 1882

This is another widespread Upper Cretaceous species which

* Fl. Böhm. Kreideformation **4**: 6. *pl. 8. p. 13, 14.* 1885.

† Cf. *Persoonia Lesquereuxii* Knowlton, Mon. U. S. Geol. Surv. **17**: 89. *pl. 20. f. 10–12.* 1892.

‡ Lesquereux, Tert. Fl. 209. *pl. 35. f. 4.* 1878.

has been found in the Black Creek formation of North Carolina. The present occurrence is based on leaflets, while the type material from the Atane beds of Greenland included not only leaflets, but also characteristic nuts and supposed aments. The present is the most southerly known occurrence of this species.

OCCURRENCE: Court House Bluff, Cape Fear River.

SALICALES

SALIX FLEXUOSA Newb. Ann. N. Y. Lyceum 9: 21. 1868

This willow, which is very common in the Magothy formation in the northern and central coastal plain, occurs sparingly in the Black Creek formation. It is present also in South Carolina and Alabama.

OCCURRENCE: Prospect Hall, Elizabethtown, Cape Fear River; Big Bend, Black River.

SALIX NEWBERRYANA Hollick, in Newb. Fl. Amboy Clays 68. *pl. 14. f. 2–7.* 1896

This serrate-margined willow leaf is present from the bottom to the top of the Raritan formation of New Jersey, but has not heretofore been found outside of that state. It is sparingly represented in North Carolina.

OCCURRENCE: Court House Bluff, Cape Fear River.

Salix eutawensis sp. nov.

Leaves lanceolate, somewhat falcate in some specimens, variable in size, from 5 cm. to 12 cm. in length and from 0.5 cm. to 2.3 cm. in greatest width, which is in the basal half of the leaf. Base lanceolate. Apex gradually narrowed to the attenuate tip. Margin entire for a short distance below, above which it is very finely dentate, even in the largest leaves collected. Petiole short and moderately stout. Midrib moderately stout, becoming thin in the apical part of the leaf, inclined to be curved or somewhat flexuous. Secondaries very fine and numerous, branching from the midrib at an acute angle and curving upward, becoming in their terminal portions approximately parallel with the margin, sending short curved tertiaries to the marginal teeth and from secondary to secondary. (PLATE 22, FIGURES 1–11.)

This species is abundant at the upper Tar River localities but has not been detected at any other localities in the Black Creek

beds of North Carolina. It is common in the Eutaw formation at Broken Arrow Bend on the Chattahoochee River in Georgia, from which place the type material was collected, and the present name was given in manuscript in allusion to the horizon. The Georgia material is more fragmentary than that from North Carolina, but withstands drying out much better, the latter being preserved in a loose carbonaceous sandy clay which furnishes miserable museum specimens. The drawings of this species were made, however, before the material had dried and weathered.

This typical willow leaf is quite modern in appearance, suggesting the existing *Salix nigra* Marsh., *Salix fluviatilis* Nutt., or the Mexican *Salix Bonplandiana* H.B.K., and is entirely distinct from any Cretaceous willows hitherto described. It approaches *Salix Newberryana* Hollick somewhat in general appearance, but is much more elongate-lanceolate in outline and ranges to a much smaller size, besides showing other distinctive features. It resembles also certain European Tertiary willows, as for example *Salix denticulata*, *S. Lavateri*, and *S. varians*. The fruits figured on the plate with the leaves of this species are found associated with these leaves and are believed to belong to the same species. These fruits are found at the second locality cited below.

OCCURRENCE: Three miles and three and one-half miles below Dunbars Bridge, Tar River, Edgecombe County, North Carolina.

SALIX LESQUEREUXII Berry, Bull. Torrey Club **36**: 252. 1909
Salix proteaefolia Lesq. Am. Jour. Sci. II. **46**: 94. 1868.

This species, which was described originally from the Dakota group, occurs in the Raritan formation but is especially abundant in the Magothy formation of the more northerly coastal plane. It is sparingly represented in the North Carolina collections but is abundant in the South Carolina Cretaceous and in the Tuscaloosa formation of Alabama.

OCCURRENCE: Big Bend, Black River.

URTICALES

Ficus Stephensoni sp. nov.

Leaves variable in size, ranging from 6 to 18 cm. in length and from 2.3 to 6.4 cm. in greatest width, broadly lanceolate-ovate,

tapering equally from the middle toward both ends but more fully rounded at the base and more slender toward the tip, especially in the smaller leaves. Midrib broad. Secondaries very slender, leaving the midrib at a wide angle, which becomes as great as 90° in some of the larger specimens, very numerous, 2–4 mm. apart, parallel, almost straight to the marginal vein, which is well marked and about 1 mm. distant from the margin, with which it is parallel. Veinlets largely at right angles to the secondaries and not especially well shown. Petiole stout. (PLATE 23, FIGURES, 2, 3.)

This is an exceedingly well-marked species of *Ficus* and is very close to various modern species in form and venation characters, as is well shown by the figure of a leaf of *Ficus elastica* Roxb. which is introduced for comparison on PLATE 23. It is probable, however, that the texture of the fossil species was less coriaceous, since all of the larger leaves are considerably macerated.

It is believed that the larger forms represent the normal size of the leaves in this species and that the smaller leaves, which occur only in material from South Carolina, represent abortive leaves which fell before reaching maturity, as is so commonly the case with the modern allied species.

The species is named in recognition of the diligent and careful collecting of Dr. L. W. Stephenson, who discoverd it at both Middendorf and Langley in South Carolina before the original material collected by the writer at Court House Bluff in North Carolina had been named.

Some authors refer leaves of this type to the genus *Eucalyptus*, with which genus the venation has much in common. In point of size the Carolina leaves are comparable with those of such a species as *Eucalyptus latifolia* Hollick, from Glen Cove, Long Island. The secondaries are less regular and only about half so numerous in the latter species and there seems to be little doubt of the propriety of referring the present species to the genus *Ficus*.

It is very similar to a variety of closely related Upper Cretaceous species of *Ficus* of the type of the existing *Ficus elastica* Roxb. and its allies, commonly cultivated as ornamental shrubs and trees under the name of "rubber plants." The comparable fossil forms include *Ficus glacoeana* Lesq. (see Fl. Dak. Group 76. *pl. 13. f. 1, 2.* 1892), with which there is a possibility that the present species may be identical, as it is very similar in outline and vena-

tion except that the figures of the Kansas leaves (types, 478 and 532a, Mus. Comp. Zoology) do not show any marginal vein, although Lesquereux mentions one in his description. The latter species has been detected southward along the western shore of the Mississippi embayment in the Woodbine formation of Texas and is of a more coriaceous texture, with more obtuse tip and with the secondaries going off at an angle of 60°. Another very similar species is *Ficus atavina* Heer (see Fl. Foss. Arct. 3^2: 108. *pl. 29. f. 2b; pl. 30. f. 1–8.* 1874) which ranges from the Atane and Patoot beds of western Greenland southward along the Atlantic coastal plain to Marthas Vineyard, Glen Cove, Long Island, and Cliffwood, N. J. (all probably of Magothy age).

The North Carolina leaf has full rounded basal margins (rather straight in *F. atavina*) with less ascending secondaries, which are also twice as numerous as in *F. atavina;* the marginal vein is also closer to the margin. Another similar species, perhaps identical with the previous one, is *Ficus Peruni* Velen.* from the Cenomanian of Bohemia, which differs from the North Carolina leaf in the same respect in which *F. atavina* Heer differs. Velenovsky points out the great similarity between *F. Peruni* and *Eucalyptus Geinitzii* Heer, a similarity which is more striking in the forms which he has referred to this species of *Eucalyptus* than it is in the leaves usually so identified by other paleobotanists.

Several specimens of *Ficus* fruits were found at Court House Bluff and at Elizabethtown farther down the river, and these may possibly be from the same trees which furnished these large leaves.

OCCURRENCE: Court House Bluff, Cape Fear River.

ROSALES

Leguminosites robiniifolia sp. nov.

Sessile elliptical leaflets about 2.5 cm. in length by 1.5 cm. in greatest width, which is slightly below the middle. Apex and base obtusely rounded, the former slightly narrower than the latter. Midrib moderately stout. Secondaries obsolete.

Better material of this species, as yet undescribed, was collected in the Middendorf formation of South Carolina.

OCCURRENCE: Court House Bluff, Cape Fear River.

* Fl. Böhm. Kreidef. 3: 16 (41). *pl. 4 (12). f. 1–3.* 1884. Compare his *fig. 2* with Berry, Bull. Torrey Club 31: *pl. 3 f. 6.* 1904.

Gleditsiophyllum gen. nov.

Compound leaves with more or less inequilateral, medium, or small leaflets, with camptodrome venation, identical with the leaflets of the modern species of *Gleditsia* * of eastern North America and Asia.

It has seemed wiser to establish a new genus for these forms whose name will indicate their resemblance to the modern genus *Gleditsia* without too great an indication of actual botanical identity since it is possible that these Cretaceous forms may represent some allied genus of the Caesalpinaceae with similar foliage. The modern *Gleditsia* has five or six upland species of eastern North America and Asia. The fossil species which have been described number eight and include remains of the living *Gleditsia triacanthos* from the Pleistocene of Kentucky and *Gleditsia donensis* from the interglacial deposits of the Don River Valley in Canada. The distribution of the Tertiary species includes two Oligocene records, five Miocene, and two Pliocene. Probably, also, certain forms referred to the comprehensive genus *Leguminosites* are related to the forms just mentioned.

Gleditsiophyllum triacanthoides sp. nov.

Leaflets ovate-lanceolate, medium in size, *i. e.*, intermediate between the large and the small leaflets of *Gleditsia triacanthos* L., about 3 cm. in length by 1 cm. in greatest width, which is about half way between the apex and the base. Apex and base bluntly pointed. Margin entire, as it often is in the modern species. Midrib of medium size. Secondaries numerous, parallel, delicate, branching from the midrib at an acute angle, less than 45°, camptodrome, exactly similar to the venation of the modern species cited.

The present is the first Cretaceous record of a *Gleditsia*-like form. It is perfectly distinct from any of the known Cretaceous leaves and resembles the European Tertiary forms of *Gleditsia* as well as certain Tertiary species of *Podogonium*. Leaflets with this outline and venation are liable to be confused with the leaves of the genus *Salix*, which may account for the absence of previous Cretaceous records.

OCCURRENCE: Three and one-half miles below Dunbars Bridge, Tar River, Edgecombe County, North Carolina.

* Often spelled *Gleditschia*, from the botanist J. T. Gleditsch.

PHASEOLITES FORMUS Lesq. Fl. Dakota Group 147. *pl. 55. f. 5, 6, 12.* 1892

This common Dakota Group species is present in considerable abundance in the Tuscaloosa formation of Alabama, so that it is not surprising to find it in North Carolina, although the material from the latter state is rather incomplete.

OCCURRENCE: Court House Bluff, Cape Fear River.

SAPINDALES

CELASTROPHYLLUM UNDULATUM Newb. Fl. Amboy Clays 102. *pl. 38. f. 1–3.* 1896

This large species is represented in the Black Creek formation by even larger leaves than those found in the New Jersey Raritan. It is reported also by Smith from the Tuscaloosa formation of Alabama.

OCCURRENCE: Court House Bluff, Cape Fear River.

THYMELEALES

LAUROPHYLLUM ELEGANS Hollick, Mon. U. S. Geol. Surv. **50**: 81. *pl. 27. f. 1–5.* 1907

Imperfect leaves of what appears to be this species, which was described in 1907 from the Cretaceous deposits of Long Island and Staten Island, occur in the Black Creek formation. It has also been recorded recently from the Magothy formation of Maryland.

OCCURRENCE: Court House Bluff, Cape Fear River.

Malapoenna horrellensis sp. nov.

Leaves ovate-lanceolate, about 8 cm. long by 2.5 cm. in greatest width, broadest at the evenly rounded or slightly acute base, narrowing gradually upward, the apex narrow and extended but obtusely pointed. Leaf substance thin but persistent, evidently coriaceous in life, since these leaves occur abundantly at a locality where all the vegetable remains except the resistant *Araucaria*, *Cunninghamites*, and *Pistia* were evidently thoroughly macerated before entombment. Secondaries 4–6 pairs, subopposite, curved upward, camptodrome, branching from the midrib at an acute angle, the lowest branching from the top of the petiole and extending upward half way to the apex or farther, giving the leaf

a triple-veined appearance (perhaps they should be termed lateral primaries, although they are much finer than the moderately stout midrib); next pair of secondaries branching at a less acute angle a considerable distance above the base, 1/3 to 1/2 the distance to the apex. Tertiary venation typically Lauraceous. (PLATE 24, FIGURES 1–9.)

The anomalous leaf of this species shown in FIG. 4 has a deeply retuse apex, giving it the appearance of a *Liriodendropsis*, which is belied by its association with the normal leaves and by the character of its venation and texture.

This species is markedly distinct from the species of Lauraceous leaves hitherto described in its rounded base, the only genus of this family with such a character being *Cinnamomum* and the present species being possibly liable to be confused with *C. Heeri* when only the basal part of the leaf is found. The general proportions and characters of the whole leaf, are, however, perfectly distinct.

The genus *Malapoenna* has more than one hundred existing species, chiefly of the oriental tropics, and is well represented in the fossil state from the Dakota and Magothy formations upward. It is especially well represented in the Paleocene of Europe and the Shoshone Group of America. There are two species in the Dakota Group of the west, one of which reappears in the Tuscaloosa formation at Cottondale, Ala., and the other in the Magothy formation of New Jersey.

OCCURRENCE: Horrell Landing, Corbits (Old Union) Bridge, Parker Landing, Tar River (?).

PRIMULALES

MYRSINE BOREALIS Heer, Fl. Foss. Arct. 3^2: 113.
pl. 32. f. 23. 1874

This is a widespread and characteristic species of the lower part of the Upper Cretaceous, with a range extending northward to Greenland (Atane beds) and southward to Alabama (Tuscaloosa formation).

OCCURRENCE: Rockfish Creek near Hope Mills; Court House Bluff, Cape Fear River.

MYRSINE GAUDINI (Lesq.) Berry, Bull. Torrey Club **36**: 262. 1909

A single leaf of this upper Raritan and Dakota Group species is present in the North Carolina collections.

OCCURRENCE: Court House Bluff, Cape Fear River.

JOHNS HOPKINS UNIVERSITY,
BALTIMORE, MARYLAND.

Explanation of plates 19-24

PLATE 19.

FIGS. 1–6. *Androvettia carolinensis* Berry. Tar River.
Figs. 1, 3, 5, natural size. Figs. 2, 4, 6, × 4.

PLATE 20.

FIGS. 1–4. *Cunninghamites elegans* (Corda) Endl. Horrell Landing.
Fig. 2. Enlarged leaf-scar (× 3).
Fig. 3. Impression of same on clay (× 3).
FIG. 5. *Moriconia americana* Berry. Elizabethtown.

PLATE 21.

FIGS. 1–15. *Pistia Nordenskioldi* (Heer) Berry.
Figs. 1–3, 5–14. A. C. L. bridge, Black River.
Fig. 4. Parker Landing, Tar River.
Fig. 15. Near Blackmans Bluff, Neuse River.

PLATE 22

FIGS. 1–11. *Salix eutawensis* Berry. Tar River.

PLATE 23

FIG. 1. Young leaf of *Ficus elastica* Roxb., for comparison.
FIGS. 2, 3. *Ficus Stephensoni* Berry. Court House Bluff.

PLATE 24

FIGS. 1–9. *Malapoenna horrellensis* Berry. Horrell Landing.

One of the hybrids in Dryopteris

MARGARET SLOSSON

In a recent number of the BULLETIN OF THE TORREY BOTANICAL CLUB * Mr. Ralph C. Benedict cites fifteen crosses as occurring between the following six of our species of *Dryopteris: D. cristata, D. Clintoniana, D. Goldiana, D. marginalis, D. spinulosa,* and *D. intermedia.* Twelve of the fifteen hybrids have been described already.† Two are held for further study. The one remaining, *D. Clintoniana* × *marginalis,* is the subject of this paper.

This group of hybrid ferns is a difficult one, and plants are often found that are by no means easy to identify. This is partly due to our lack of knowledge of the range of variation normal to some of the parent species, or to be found in the different hybrids. *D. cristata* × *marginalis,* one of the best known and most common members of the group, appears to have a perfectly definite range of variation. It is impossible to say at present whether this is true of the others or not. Few have been collected in sufficient quantities to justify a conclusion. Most of them represent problems to be worked out.

The case is simplified by the fact that as a rule, at least, either the sporangia of these hybrids are abortive, or the spores, if present, are abnormal, and fertile hybrids, etc., are thus not likely to occur and confuse the outlook. Perhaps an exception to this may be found in *D. cristata* × *intermedia* (*D. Boottii*). Certainly the many plants of this hybrid, which occur so often, seem to indicate either a much more frequent hybridization than would be supposed probable, or some means of reproduction of the hybrid, perhaps asexual growth of some kind.

Dryopteris Clintoniana × *marginalis* I collected first at Pittsford, Vermont, in 1897, and again several times since then in

* 36 : 41–49. 1909.

† See Bull. Torrey Club 35 : 135–140. 1908; 36 : 41–49. 1909. — Rhodora 6 : 75–77. 1904. — Bot. Gaz. 19 : 492–495. 1894.

the same locality. It grows there on the outskirts of a deeply wooded sphagnum swamp, near plants of both *D. Clintoniana* and *D. marginalis*. It may be described as follows:

Dryopteris Clintoniana × marginalis hyb. nov.

Rhizome stout, caudiciform or more or less decumbent; stipes about one third to seven eighths as long as the laminae; stipe-scales large and small mixed, light brown, often with dark centers, lanceolate to ovate, acuminate, subentire or ciliate-toothed; laminae 35–60 cm. long, 16–25 cm. broad, oblong-lanceolate or elliptic, acuminate; pinnae, excepting the uppermost, short-stipitate, varying from oblong-lanceolate to elliptic-lanceolate in the main part of the laminae to ovate-lanceolate at or near the base, mostly all long-acuminate, deeply pinnatifid or at base subpinnate, inequilateral, the inferior pinnulae the longest; pinnulae oblique, often subfalcate, oblong or ovate-oblong to lanceolate, obtuse or the longer often subacute to long-acute, the longest either at or near center or base of the pinna, few, usually the basal if any, constricted at base, obscurely notched or toothed or sparingly crenate-serrately toothed or lobed, the lobes often obscurely toothed; sori about 3–7 (rarely 8 or 9) pairs, nearer midveins than margins or midway between, a few occasionally submarginal; indusia glabrous.

Type in the Underwood Fern Herbarium, New York Botanical Garden, *M. Slosson*, from Pittsford, Vermont, 1908. Collected also by R. C. Benedict at Cornwall, Connecticut, July, 1907, and June, 1909; by E. J. Winslow at Barton Landing, Vt., 1905; by E. Brainerd at Middlebury, Vt., 1908 and 1909; and by H. G. Rugg, at Dorset, Vt., 1909.

The lack of resemblance of *Dryopteris Clintoniana* × *marginalis* to *D. Clintoniana* may perhaps be best defined as its suggestiveness of *D. marginalis* in outline of lamina, pinnae, and pinnulae, a suggestiveness which *D. Clintoniana* lacks altogether. Noticeable points of distinction from *Dryopteris Clintoniana* are the greater proportional breadth of the hybrid's leaf, its conspicuously attenuate apices, its color, nearer that of *D. marginalis*, the varying position of its sori, and its oblique often subfalcate pinnulae.

From *Dryopteris cristata* × *marginalis*, *D. Clintoniana* × *marginalis* may be most easily distinguished by the greater proportional breadth of the lower part of the lamina, coupled mostly with attenuate apices of all, even the basal, pinnae; by the position of

its sori, often nearer the midveins than in *D. cristata* × *marginalis;* and as a rule by its scales, which usually have dark centers, while those of *D. cristata* × *marginalis* appear uniformly light brown, so far as observed. But dark-centered scales do occur sometimes in *D. marginalis*, so are to be looked for in any of its hybrids. They are common in *Dryopteris marginalis* × *spinulosa* (*D. pittsfordensis*).

In 1902 Mr. George E. Davenport described in Rhodora * an anomalous plant as baffling identification, but suggested it might prove to be *D. Clintoniana* × *marginalis.* I have seen only scraps of pinnae of this plant, and have not been able to find out if other specimens are now in existence. Neither these scraps nor the published description of the plant tallies with anything I have seen that appeared unmistakably *D. Clintoniana* × *marginalis*, and it does not seem probable that the plant can have been this hybrid.

I am indebted to Dr. Ezra Brainerd, Dr. Philip Dowell, Mr. Ralph C. Benedict, and Mr. Harold G. Rugg for the privilege of examining material.

NEW YORK CITY.

*4: 10–13.

Stemphylium Tritici sp. nov., associated with floret sterility of wheat

FLORA W. PATTERSON

Among the fungi associated with floret sterility of wheat in the southwest, transmitted for identification to the Bureau of Plant Industry, was a *Stemphylium* sp., which appears not to have been described. It is of considerable pathological importance; some artificial inoculations resulted in producing 9 per cent. of sterile florets:* "In nature the *Stemphylium* was prevalent on the leaves of wheat and almost invariably present in diseased ovaries, through the tissues of which the mycelium ramifies and produces conidia on the surface."

Stemphylium Tritici sp. nov.

Hyphae decumbent, irregularly branched, fuliginous; fertile branches upright, closely septate, 4–5 μ in diameter; conidia muriform, catenulate, irregular, generally clavate, constricted slightly at the septa, 24–35 μ × 12–15 μ, fuliginous, verrucose; isthmus short, 3–4 μ in diameter.

In living leaves and ovaries of *Triticum sativum*, in Texas and Oklahoma, U. S. A.

Hyphis decumbentibus, irregulariter ramosis, fuligineis; ramis fertilibus erectis, brevi-septulatis, 4–5 μ diam.; conidiis muriformibus, catenulatis, irregularibus, plerumque clavatis, ad septum leniter constrictis, 24–35 μ × 12–15 μ, fuligineis, verruculosis, isthmis brevibus, 3–4 μ diam.

In foliis vivis et ovariis *Tritici sativi* in Texas et Oklahoma in Amer. bor.

BUREAU OF PLANT INDUSTRY,
U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

* Edw. C. Johnson. Floret sterility of wheat in the southwest. Paper read before the American Phytopathological Society, at Boston, Dec. 31, 1909.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1910)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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